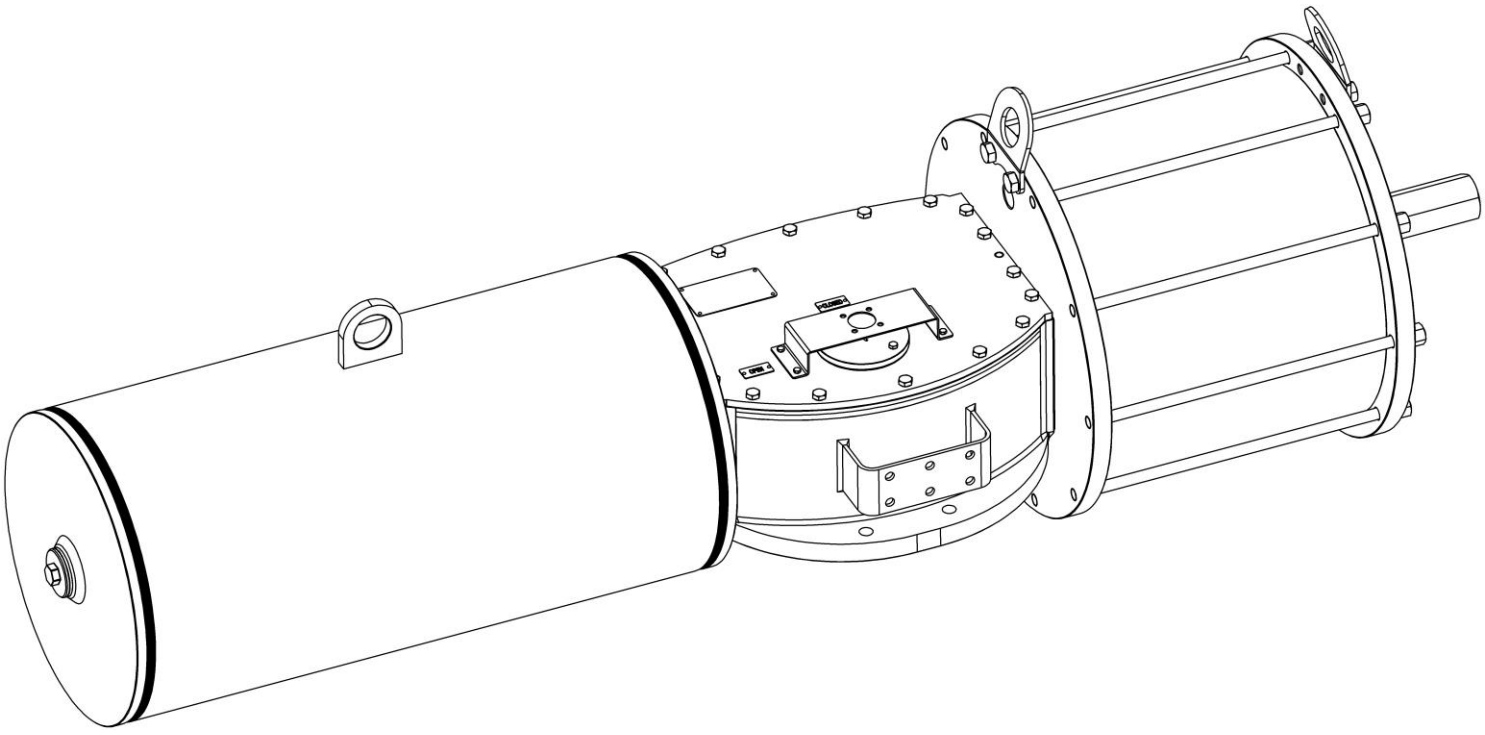
INSTALLATION, COMMISSIONING AND MAINTENANCE USER MANUAL

GHDP – SERIES

SPRING RETURN PNEUMATIC ACTUATORS



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USE AND STORAGE OF THIS MANUAL

The user manual has to be considered as an integral part of the pressure equipment supplied and must be kept until final disposal of the equipment.

The manual must be always available for consulting near where the equipment is located and conserved in dry dust free environment.

In case of loss of this manual the customer can require a copy of this, specifying serial number, actuator type, date, version and year of supply as indicated on the actuators name plate.

INTRODUCTION

Read completely this manual before start any operation with or on the Actuatech GHDP series actuators.

This manual is produced to enable a competent user to install, operate, adjust, inspect and maintain Actuatech GHDP Series actuator. Users are responsible to follow the instructions in this manual as well as any additional documentation that has been supplied regarding the actuator or accessories supplied by Actuatech S.p.A. . Should further information or guidance relating to the safe use of GHDP range actuators be required, it will be provided on request. Users are also responsible to be familiar with and follow any relevant legislation or statutory provisions regarding health and safety.

It is the users' responsibility to ensure that the equipment is operated in a safe manner and that any personnel working with or on the equipment are properly trained for the work they are performing and are also aware of their responsibilities relating to health and safety in the workplace. It is extremely important that precautions are taken to avoid spark or static discharge in any areas of potentially explosive atmosphere.

All Actuatech actuators are tested prior to despatch.

PRESENTATION

1- DESCRIPTION OF SPRING RETURN GHDP SERIES ACTUATORS

The GHDP series actuators are pneumatic actuators specifically designed to guarantee efficiency and reliability in heavy duty services.
The main components of spring return version units are the following:

1.1 A scotch-yoke mechanism which transforms the linear movement of the pneumatic cylinder into a rotary movement suitable to operate quarter turn valves, such as ball valves, butterfly valves or plug valves.
The scotch-yoke mechanism is included into a perfectly sealed housing, made of welded carbon steel, which protects it against corrosion and that guarantees safety to the personnel during the operations. It is also fitted with a guide bar suitable to support the transverse forces and to ensure the proper alignment of the piston rod, and with sliding blocks and yoke bushings, made of bronze, suitable to reduce the friction and to guarantee a long working life. In particular the guide bar is chromium plated in order to guarantee its protection against corrosion.

1.2 The pneumatic cylinder made of carbon steel.
The cylinder tube is electrolysis nickel plated internally, in order to reduce roughness of the surface to a minimum value and to provide highest protection against corrosion.
The relevant piston is made of carbon steel and is sealed by O-rings and by a guide sliding ring in PTFE and graphite. The dynamic seals of the cylinder are specifically designed to allow the use of the actuator without lubrication.

1.3 Two mechanical stops to allow the adjustment of the valve angular stroke by means of the stop screws, which are screwed into end flange of the pneumatic cylinder and into the spring pack closing flange.

1.4 Mechanical visual indicator of the position directly connected to the valve stem, which shows the valve position during the entire actuator stroke.

1.5 The spring pack is completely sealed and protected from the external environment.

If required, the GHDP series of actuators may also be supplied complete with accessories such as positioner, signalling switches position transmitter, etc.

STORAGE AND PRE-INSTALLATION

1- CHECKS TO BE CARRIED OUT AT THE RECEIPT OF THE ACTUATOR

ACTUATOR DATA PLATE

The following information are mentioned on the actuator data plate:

- Type;
- Serial Number;
- Order Number;
- Allowable temperature range;
- Supply pressure range;
- Supply fluid;
- Code;
- Construction year;

Please check that the information marked on the data-plate conforms with those specified on the order, on the test certificate and on the delivery note.

DAMAGE DURING TRANSPORT

On receipt of actuator, check that it has not been damaged during the transport.
In case of damage of the paint work, proceed to repair by following the applicable painting specification.

ACCESSORIES

When the supply includes accessories, please check that they are in conformity with those listed in the order and in the shipping documents.

SETTING OF MECHANICAL STOPS AND LIMIT SWITCHES

In the event that the actuator has been delivered already assembled onto the valve, the mechanical stops and electric limit switches (if existing) have already been set during the relevant assembling operations.

In the event that the actuator has been delivered separately from the valve, the setting of the mechanical stops and electric limit switches (if existing) has to be checked and, if necessary, carried out after the assembling of the actuator onto the valve according to the instructions stated in this manual under the applicable sections.

2- STORAGE

GENERAL INSTRUCTIONS

The actuators leave the Actuatech S.p.A. factory in excellent finish and working conditions which are guaranteed by the inspection certificate issued for each single actuator.

In order to keep the actuators in good conditions until they are assembled on the plant, it is recommended to follow the rules listed here below, during the storage period:

- Check that the plugs are properly assembled on the pneumatic and electric connections, in order to avoid entry of foreign matters and water during transport and storage;
- The actuators, which are not yet assembled onto the valves, must be placed onto a wooden pallet, in order to prevent any damage to the valve coupling flange.

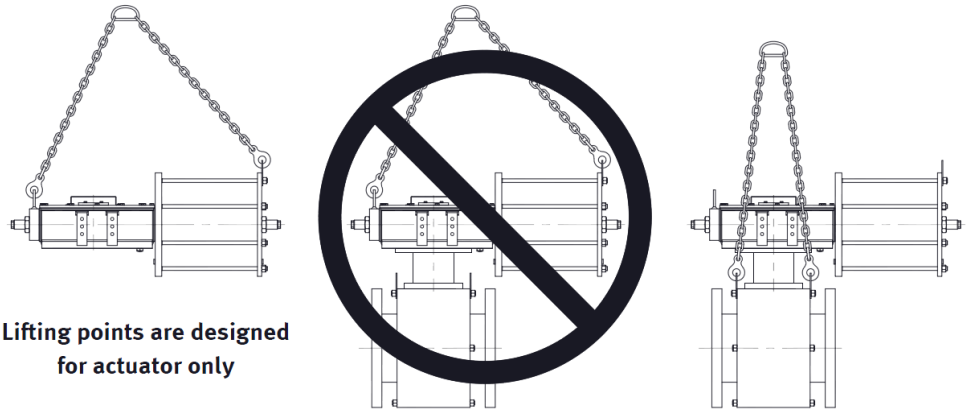
LONG TERM STORAGE

In the event of a long-term storage, the following rules are also recommended:

- Protect the coupling parts (adapter and coupling joint, flange, etc.) with grease or protective oil;
- Keep the actuators in a dry place or provide some means of protection against the direct action of weather agents;
- If possible, we also recommend operating periodically the actuators with filtered and dehydrated air. Remember that after this operation all the threaded connections of the actuator and of the control panel must be carefully closed.

MOVIMENTATION

- The actuator is normally supplied in boxes or on pallets that ensure the stability and protection against damage during movement.
- For handling the actuator use the appropriate lifting rings.
- Use belts or chains suitable to the weight of the actuator to be lifted.
- Attention : the lifting rings are designed to lift actuator only.



Lifting points are designed for actuator only

3- INSTRUCTION TO ASSEMBLE THE ACTUATOR ONTO THE VALVE

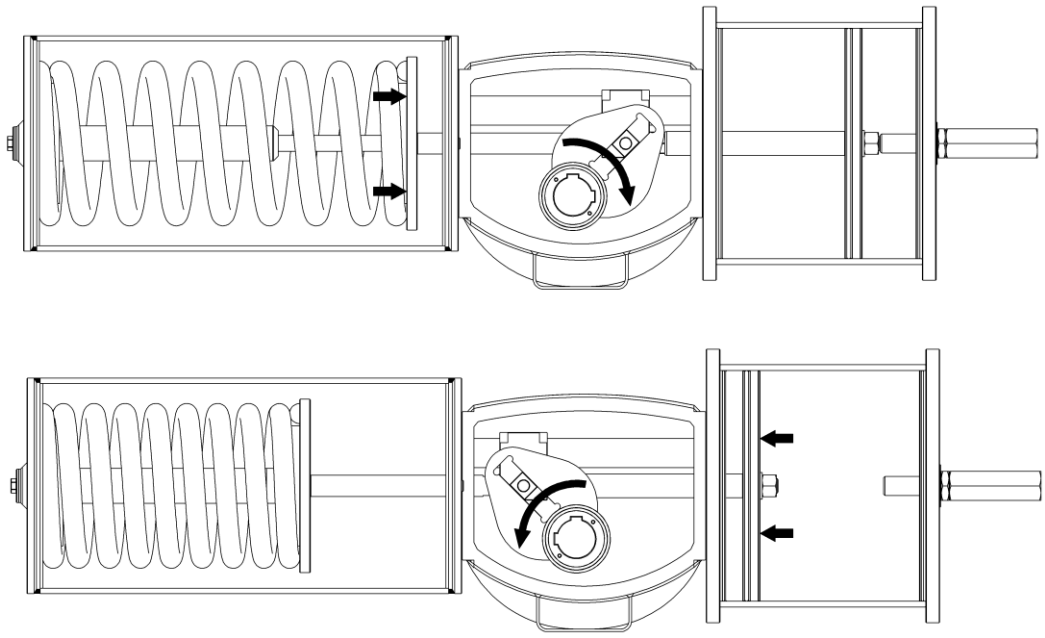
The assembling of the actuator onto the valve can be performed:

- Directly on the valve, using the actuator housing flange with threaded holes;
- By interposing an adapter and a coupling joint.

The standard assembly position of the actuator is made with cylinder axis parallel to the pipeline axis but must be in accordance with plant requirements (perpendicular to the pipeline axis on request) and with the valve model.

In order to assemble the actuator onto the valve, proceed as follows:

1. Check that the coupling dimensions of the valve flange and those of the valve stem meet the coupling dimensions of the actuator.
2. Arrange the valve in the open or closed position (according to the current position of the actuator). The piston, the spring and the scotch-yoke of standard (fail to close) Spring Return GHDP actuators are mounted as shown below: supplying the pressurized air in the external chamber the drive shaft rotates counter clockwise to open.

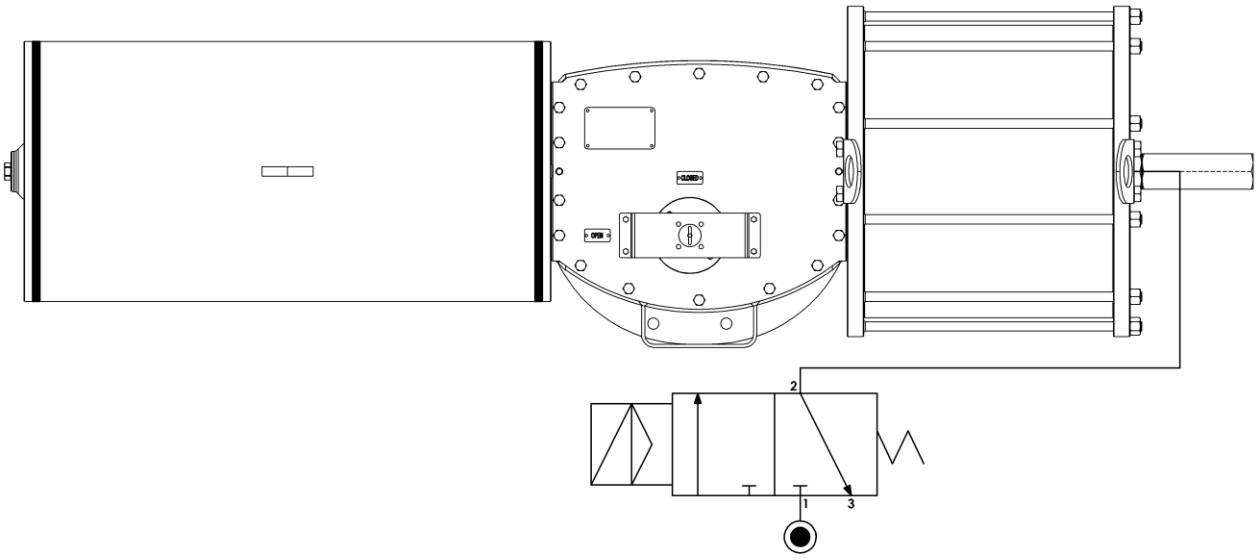


3. Clean the coupling flanges of the valve and of the actuator and remove whatever might prevent their perfect adherence. Take care to remove oil and grease perfectly.
4. Lubricate the valve stem with oil or grease, in order to make the assembling easier.
5. Lift the actuator, by connecting hooks, chains or lifting belts, to the supporting points of the actuator. If possible, place the valve stem in the vertical position in order to make the assembling easier.

6. If the assembling operation is carried out by means of an adapter with a coupling joint (supplied with the actuator as a separate part), assemble it onto the valve stem, before proceeding with the assembling of the actuator.
7. Lower the actuator onto the valve so that the valve stem slips in the actuator yoke. Fasten the actuator to the valve by means of the stud bolts, which are screwed to its coupling flange.
8. Tighten the nuts of the connecting stud bolts by following the recommended tightening torque listed here below:

THREAD SIZE	RECOMMENDED TIGHTENING TORQUE
M6	8.5 Nm
M8	20 Nm
M10	40 Nm
M12	70 Nm
M14	110 Nm
M16	160 Nm
M20	320 Nm
M22	420 Nm
M24	550 Nm
M27	800 Nm
M30	1100 Nm
M33	1400 Nm
M36	1700 Nm

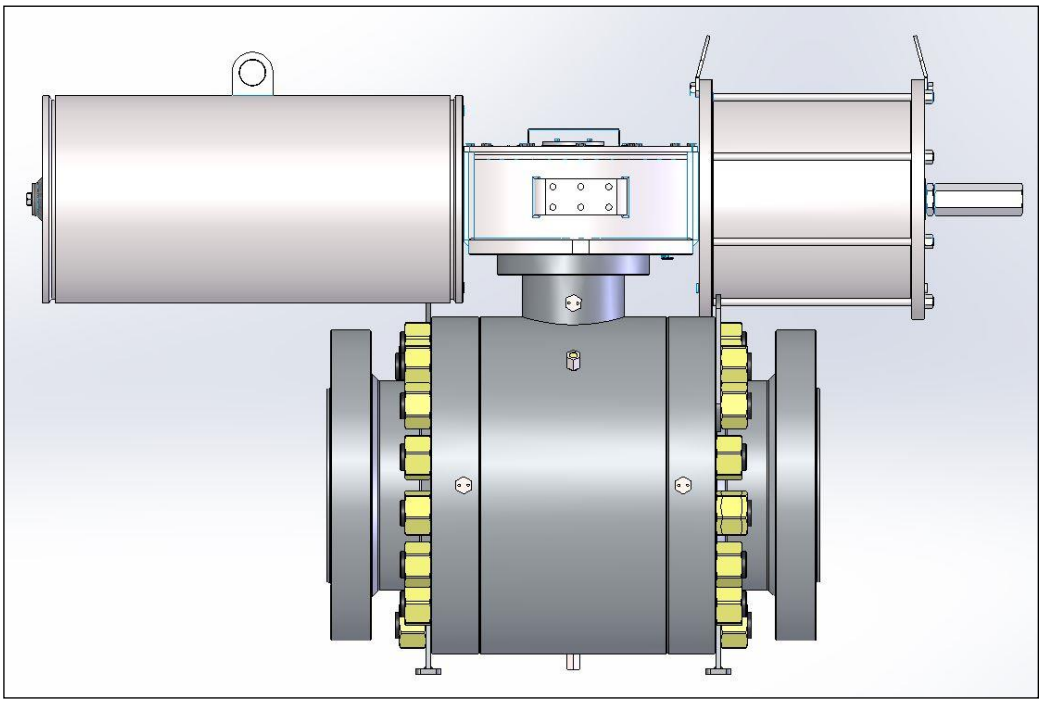
9. The actuator remote control functionality should be done respecting the air connection schema shown below:



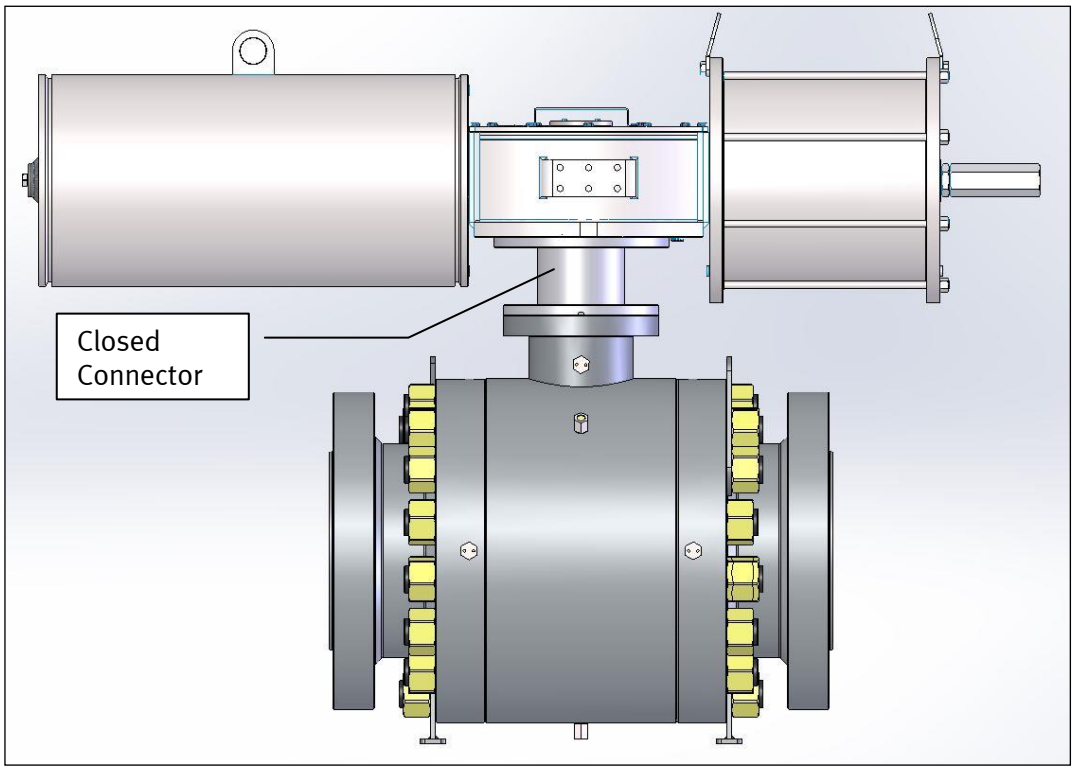
Attention: the customer must take precautions to prevent the actuator chamber unmanned does not aspire from the outside air not filtered, moisture, water or other substances harmful for the actuator.

10. If possible, operate the actuator in order to check that it actuates smoothly the valve. Before this operation, verify that supply fluid composition, filtration and hydration correspond to the ranges for which the actuator was designed. In case of doubts please see the “Motive Energy” section on this manual or contact Actuatech technical department.

Direct assembling



Assembling by interposing an adapter and a coupling joint.
In case of use of an adapter for the connection of the valve using the connection with the socket closed so as to ensure a complete protection of the moving parts (joint), see image below.

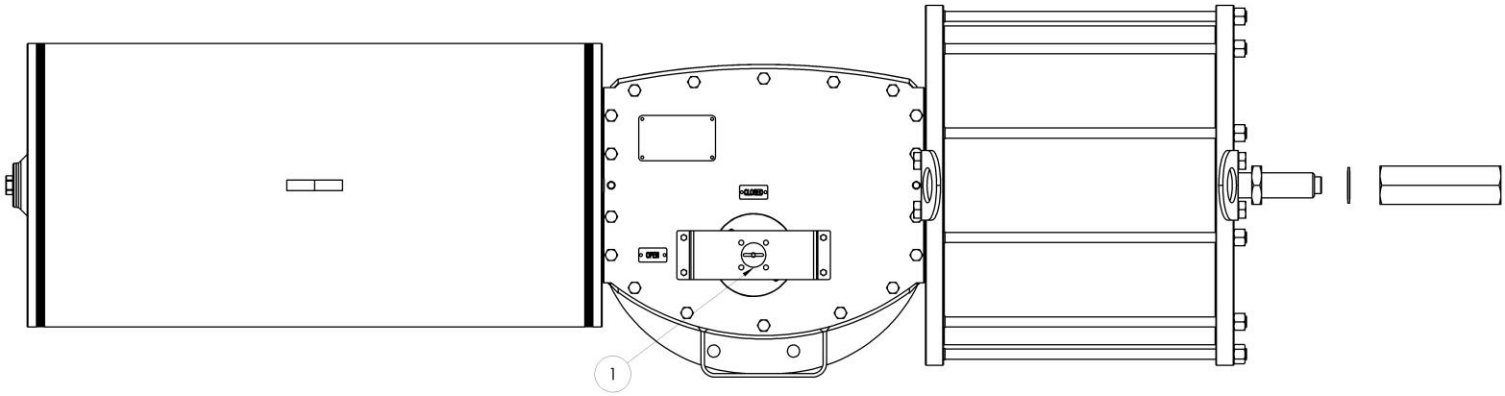


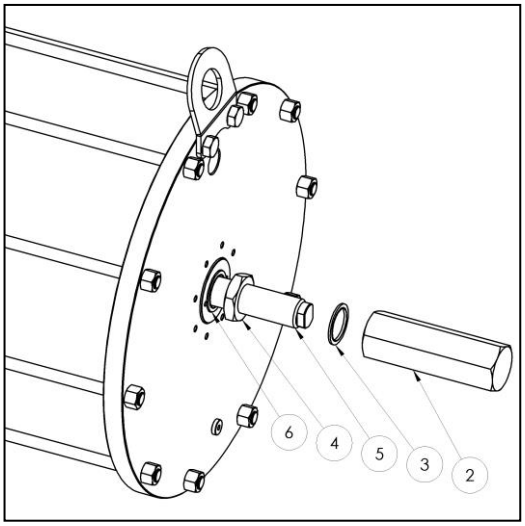
SETTING

1- SETTING OF ANGULAR STROKE

A- SPRING RETURN PNEUMATIC ACTUATOR WITHOUT MANUAL OVERRIDE

A.1- SETTING OF THE POSITION 'CLOSED VALVE' (on standard N.C. actuator)

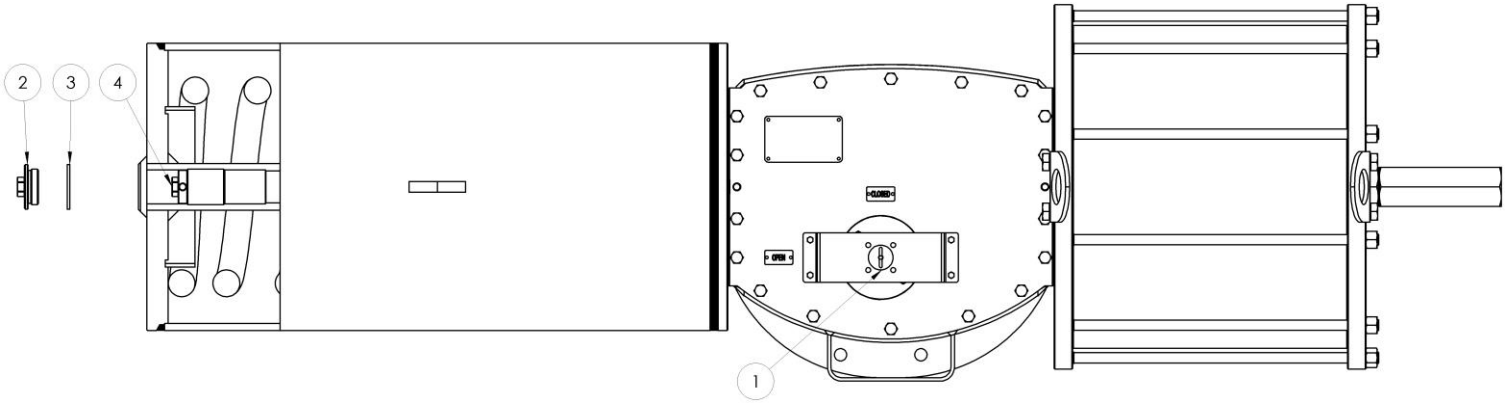


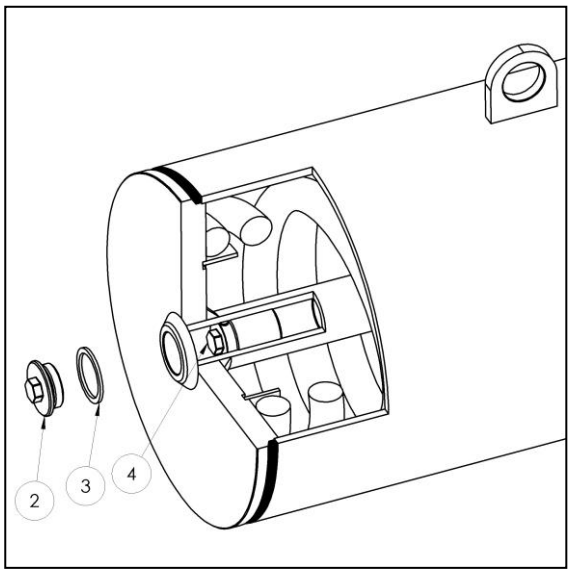


The setting of the closed valve position is performed by adjusting the screw which is inserted into the end flange of the pneumatic cylinder as follows:

1. Apply (low) pressure to outboard side of cylinder to remove load from stop bolt (1) .
2. Remove the stop bolt cover (2) the sealing washer (3) and loosen the stop nut (4) with sealing washer (6).
3. Screw the stop setting screw (5) to reduce the actuator angular stroke or unscrew the stop setting screw (5) to increase the actuator angular stroke.
4. Tighten the stop nut (4) ensuring sealing washer (6) is properly centred on the stop setting screw and fitted in the machined recess in the flange.
5. Operate the actuator in open valve position (apply pressure to outboard side of cylinder).
6. Operate the actuator in closed valve position (remove pressure of the outboard side of cylinder).
7. Verify that the adjustment is correct; otherwise repeat from the step 1.
8. Reinstall the stop bolt cover (2) ensuring sealing washer (3) is properly centred on the stop setting screw and fitted in the machined recess in the stop bolt cover.

A.2- SETTING OF THE POSITION 'OPEN VALVE' (on standard N.C. actuator)





The setting of the open valve position is performed by adjusting the screw which is screwed into the spring pack:

1. Depressurize the cylinder to allow the spring to relax (1) .
2. Remove the spring stop cap (2) and the sealing washer (3).
3. Screw the spring stop (4) to reduce the actuator angular stroke or unscrew the spring stop (4) to increase the actuator angular stroke.
4. Operate the actuator in closed valve position (remove pressure of the outboard side of cylinder).
5. Operate the actuator in open valve position (apply pressure to outboard side of cylinder).
6. Verify that the adjustment is correct; otherwise repeat from the step 1.
7. Replace the sealing washer (3) and the spring stop cap (2) ensuring sealing washer (3) is properly centred on the spring stop cap (2).

START-UP

1- ARRANGEMENT FOR START-UP

PNEUMATIC CONNECTIONS

1. Before connecting the actuator to the pneumatic supply line, check that pipes and fittings are according to the applicable plant specifications, in order to guarantee the required air flow for the operation of the actuator and to avoid that the supply pressure drops below the minimum allowable value.
2. Clean the inside of the pipes used for connection by washing them with suitable detergent and by blowing air into them. Take every precaution to remove any solid or liquid foreign matter from the pipe work to the actuator, so as to avoid possible damages to the actuator itself or loss of performance.
3. Fasten the piping in a right way, in order not to cause loosening of threaded connections, in the event that the system may be subject to strong vibrations.
4. After the completion of the pneumatic connections, operate the actuator in order to ensure that it works correctly. Also check that there are not leakages in the pneumatic connections.

ELECTRIC CONNECTIONS

The following instructions are applicable to actuators provided with electric accessories (such as solenoid valves, limit switches, etc.)

1. Check that the components used for electrical connections (such as cable hose conduits, cable glands) are in accordance with the requirements and codes applicable to the plant, with reference to the mechanical and/or explosion-proof protection.
2. The electric connection has to be carried out in order to avoid anomalous mechanical stresses in the cable entries, both by using rigid conduits and trailing cables.
3. Remove the plugs from cable entries.
4. Connect the electric feed, control and signal lines to the actuator, by linking them up with the terminal blocks of electric components in accordance with the applicable wiring diagram.
5. Replace plastic plugs with metal plugs on the unused entries of the pull box, in order to guarantee perfect seal and to comply with explosion proof protection codes (where applicable).
6. Check that controls and signals are properly working, when connections have been completed.

MOTIVE ENERGY

The operating media should be dry and filtered compressed air not necessarily lubricated or inert gases compatible with internal actuator parts and lubricants.

The operating media shall have a dew point equal to – 20 °C or, to be at least, 10 °C below the ambient temperature (ISO 8573-1, Class 3).

The maximum particle size shall not exceed 40 µm (ISO 8573-1, Class 5).

Check that the pressure is in not in excess to the maximum value as indicated on the nameplate.

2- START-UP

During the start-up of the actuator, it is necessary to check that:

- The pressure of the process supply, as well as its quality (filtering, degree, dehydration) are as prescribed.
- The pressure in the cylinder do not exceed the range indicated on the actuator's nameplate.
- Use appropriate systems to avoid the risk of overpressure.
- The air cylinder exhaust is piped in safe areas and put in positions not dangerous for the operators.
- The pneumatic connections do not show any leakage. If necessary, tighten the nuts of the pipe fittings.
- The feed voltage values of the electric components (solenoid valves coils, micro switches, pressure switches etc., if applicable) are as prescribed.
- The required remote signals (such as valve position, air pressure, etc.) are correct.
- The actuator controls, such as remote control, local control, emergency control etc. (if applicable), are properly working.
- The setting of the components of the actuator control unit is according to the requirements of the plant.
- The painted parts have not been damaged during the transport, assembling or storage operations. If it is necessary, after having removed rust, repair the damaged parts by following the applicable painting specifications.

MAINTENANCE

1- GENERAL.

As a general rule, based on our many years of experience in the field, together with our customers know-how, Actuatech technical department has selected materials of construction and improved constructive principles that can specifically guarantee efficiency and reliability in heavy duty services for a long expected lifetime.
Actuatech actuators do not normally need any periodic maintenance. However we recommend to follow regular testing and inspection schedule.

2- « OFF-LINE » PERIODIC TESTING.

Off-line periodic testing activity is: **Proof Test (PT)**.

Actuatech recommends performing Proof Test to verify the correct operation of the actuator. Proof Test is a full 90 degrees stroke.

When the working conditions of the plant allow to do, carry out some opening and closing operations with all the existing controls (such as remote control - local control - emergency control) and verify the actuator operates the valve correctly, with the required operating time. If some fault is noticed please consult troubleshooting table for resolution.
The recommended Proof Test interval (TI) is 1 Year (8760 h), and it allows detecting: torque decrease, actuator blockage, structural problems in scotch yoke and pneumatic cylinder components, external leakage.

3- « ON-LINE » PERIODIC INSPECTION AND TESTING.

On-line periodic testing activity is: **Visual Inspection (VI)** and **Partial Stroke Test (PST)**.

Visual Inspection is an accurate external inspection of actuator. Visual Inspection can reveal and prevent: external corrosion, external leakage and problems in scotch yoke and pneumatic cylinder external components.

Actuatech advises to perform Visual Inspection, and to verify:
-The signals to the control board are correct.
-The process supply pressure value is within the required range.
-The external components of the actuator are in good conditions.
-The pneumatic connections do not show any leakage (if necessary, tighten the nuts of the pipe fittings).
-The painting work of the actuator is not been damaged (if necessary, touch-up damaged areas according to the applicable painting specifications).

The advised Visual Inspection interval (TI_{VI}) is 6 months (4380 h), and in any case it should be performed when Proof Tests and Partial Proof Tests are performed.
Partial Stroke Test can reveal and prevent the same functional failures than Proof Test.
If some fault is noticed please consult troubleshooting table for resolution.
The advised Partial Test interval (TI_{PS}) is 3 months (2190 h), and it allows detecting: torque decrease, actuator blockage, structural problems in scotch yoke and pneumatic cylinder components, external leakage.

4- EXTRAORDINARY MAINTENANCE

REPLACEMENT OF THE PISTON AND CYLINDER SEALS

Usually it is not necessary to replace the piston and cylinder seals, but when for an out of ordinary use, the seals must be replaced, proceed as described here below:

- Apply (low) pressure to outboard side of cylinder to remove load from stop bolt.
- Remove the stop bolt cover, the sealing washer and loosen the stop nut with sealing washer.
- Unscrew the stop setting screw until it sticks out about 180mm from the flange.
- Disconnect all pneumatic and electrical supply connections.
- Make sure that there is no pressure in any part of the actuator.
- Unscrew the nuts from the tie rods.
- Remove the bottom flange.
- Remove the cylinder tube.
- Remove the O-ring and the guide sliding ring from the piston.
- Unscrew the screws on the central body cover and remove the cover and the central body gasket.
- Holding the stem from the hexagon near the guide block unscrew the nut; remove it with relative washer.
- Remove the piston together with the shoulder washer and O-ring.
- Unscrew the grub screw that locks the stem of the piston in the guide block.
- Unscrew the stem of the piston from the guide block and remove it from the head flange.
- Remove the stem gasket and the relative O-ring from the head flange.
- Remove the external O-rings on both flanges.
- Carefully clean all the gasket grooves.
- Replace all the above mentioned seals and lubricate them with a grease film (please consult “Lubrication” section).

Taking care not to damage the seals, proceed with the reassembling as follows:

- Insert the stem of the piston into the head flange.
- Add threadlocker and screw the stem in the guide block (see page 7 for the recommended tightening torques).
- Add threadlocker and screw the grub screw on the guide block to lock piston stem.
- Reassemble the piston with the shoulder washer and O-ring on the stem.
- Add threadlocker and screw the nut with relative washer (see page 7 for the recommended tightening torques).
- Lubricate the flange gaskets and the piston seals and reassemble the cylinder tube and the bottom flange.
- Add threadlocker and uniformly screw the nuts on the tie rods (see page 7 for the recommended tightening torques).
- Lubricate the parts inside the central body (please consult “Lubrication” section) and reassemble the cover with his gasket and screw the central body screws.
- Re-make the setting of angular stroke (see ”Setting" section).
- Carry out a few operations with the actuator, in order to check that the movement is regular and that there are no leakages through the seals.

REPLACEMENT OF ONLY THE DYNAMIC PISTON SEALS

Usually it is not necessary to replace the piston seals, but when for an out of ordinary use, the piston seals must be replaced, proceed as described here below:

- Apply (low) pressure to outboard side of cylinder to remove load from stop bolt.
- Remove the stop bolt cover, the sealing washer and loosen the stop nut with sealing washer.
- Unscrew the stop setting screw until it sticks out about 180mm from the flange.
- Disconnect all pneumatic and electrical supply connections.
- Make sure that there is no pressure in any part of the actuator.
- Unscrew the nuts from the tie rods.
- Remove the bottom flange.
- Remove the cylinder tube.
- Remove the O-ring and the guide sliding ring from the piston.
- Clean the piston gasket grooves and replace the O-ring and the guide sliding ring.
- Lubricate them with a grease film (please consult “Lubrication” section).

Taking care not to damage the seals, proceed with the reassembling as follows:

- Lubricate the flange gaskets and the piston seals and reassemble the cylinder tube and the bottom flange.
- Add threadlocker and uniformly screw the nuts on the tie rods (see page 7 for the recommended tightening torques).
- Re-make the setting of angular stroke (see ”Setting" section).
- Carry out a few operations with the actuator, in order to check that the movement is regular and that there are no leakages through the seals.

Attention: See page 8 for the recommended tightening torques.

LUBRICATION

Usually it is not necessary to lubricate the actuator, because its mechanism is lubricated for life.

The following greases are used by Actuatech S.p.A. to lubricate the mechanical components and are recommended for future lubrication (all the greases are silicon free):

PISTON - CYLINDER lubrication

MANUFACTURER: TECNOLUBE SEAL

TRADE NAME: SYNTHY POLYMER 402

COLOR: BLUE

OIL TYPE: SYNTHETIC

SCOTCH-YOKE MECHANISM – HOUSING – GUIDE BAR lubrication

MANUFACTURER: MOLYKOTE

TRADE NAME: P1500

COLOR: WHITE

OIL TYPE: SEMI-SYNTHETIC

NOTE:

The above described greases types are for lubrication of scotch yoke standard actuators (–20°C +80°C) .

WARNINGS

It is the responsibility of the user to ensure that the following conditions are respected:

1. The pressure in the cylinder must not exceed the range indicated on the actuator's nameplate. The pneumatic supply line must take in account the necessary precautions in order to respect the required conditions.

2. Use appropriate systems to avoid the risk of overpressure.

3. The air cylinder exhaust must be piped in safe areas and put in positions not dangerous for the operators.

4. Check that the noise emitted from the exhaust of the cylinder respect current standards.

5. The temperature of the cylinder must not exceed the range indicated on the actuator's nameplate. Important factors such as the temperature of the valve and pipeline, as well as of the local environment and sun exposition will affect the actuator temperature and should be considered.

6. Ensure that environmental conditions are compatible with design-presumed conditions. In case of doubts please contact Actuatech technical department.

7. Verify that supply fluid composition, filtration and hydration correspond to the ranges for which the actuator was designed. In case of doubts please see the "Motive Energy" section on this manual or contact Actuatech technical department.

8. Don't use the cylinder for any other uses other than which it has been designed.

9. Follow regular maintenance schedule (please consult "Maintenance" section).

10. Before doing any maintenance operation on the actuator it is imperative to ensure that no pressure remains inside the cylinder or other part of actuator.

11. The lifting-points placed on the actuator are designed only for actuator lifting (do not use these lifting points to lift actuator + valve).

12. Actuatech S.p.A. cannot be responsible for any damage to people, animals or things due to an improper use of the product.

13. Actuatech S.p.A. declines any responsibility for the products repaired by companies not authorised by Actuatech S.p.A.

Other extra-warnings linked to the particular installation of the actuator must be taken into account by the installer.

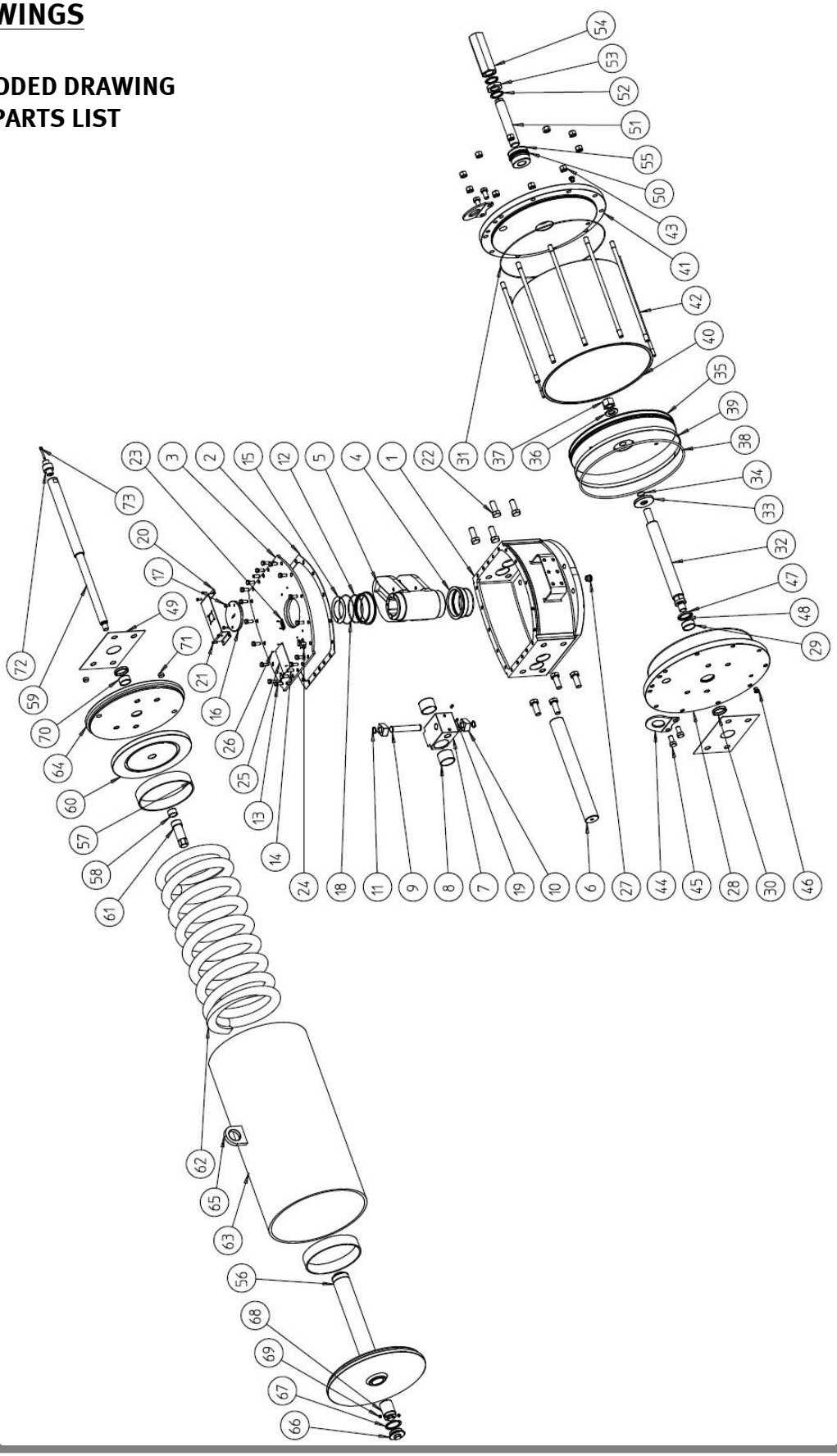
TROUBLESHOOTING

NOTICED FAULT	POSSIBLE CAUSE	SUGGESTED REMEDY
APPARENT TORQUE DECREASE.	Not adequate supply pressure.	Verify that the process supply pressure value is within the required range pressure of the actuator (See actuator data plate).
		Check regulator's filter. If necessary substitute it.
	Pipe work leakage.	Check the pipe work for leakage. If necessary tighten the nuts of the pipe fittings.
	One or both port blocked	Remove the fittings , clean the ports and reassemble the fittings
	Wrong flow control valve settings.	Adjust flow control valves settings to increase supply flow.
	Exhaust port silencers blocked.	Remove and clean silencers.
		Check if during operations silencers are frozen; adjust flow control valves settings to decrease supply flow.
	Defective controls.	Check the controls status, reset if necessary. Check and refer to components manufacturer's supplied user manual.
	Increased valve torque.	Check the valve manufacturer's documentation.
	Wrong valve sizing.	Check the required valve torque (valve manufacturer's documentation) and the provided actuator torque (Actuatech documentation).
	Internal Leakage (Damaged piston seals).	Replacement of the piston seals (see "Extraordinary Maintenance" above).
	External Leakage (Damaged cylinder seals).	Replacement of the cylinder seals (see "Extraordinary Maintenance" above).
STROKE NOT COMPLETED.	Setting of mechanical stops and/or limit switches not correct.	See above "Setting of angular stroke".
	Encrusted hardened lubricant.	Disassemble cylinder components (See above "Extraordinary Maintenance"), remove the encrusted lubricant, re-lubricate (See above "Lubrication") and reassemble.
	Defective valve.	Check the valve manufacturer's documentation.
	Debris left in the cylinder during extraordinary maintenance.	Disassemble cylinder components (See above "Extraordinary Maintenance"), check the presence of debris and if necessary remove them. Reassemble.

NOTICED FAULT	POSSIBLE CAUSE	SUGGESTED REMEDY
IRREGULAR STROKE MOVEMENT.	Not regular pressure of process supply pressure.	Check supplied air pressure and if necessary correct and improve its regularity.
	Not adequate lubrication.	Disassemble cylinder components (See above “Extraordinary Maintenance”), remove the old lubricant, re-lubricate (See above “Lubrication”) and reassemble.
	Worn or sticked valve.	Check the valve manufacturer’s documentation.
	Worn components.	Consult Actuatech technical department for instructions.

DRAWINGS

EXPLODED DRAWING AND PARTS LIST



Num. Item	Description	Material	Quantity
1	Housing	Carbon Steel	1
2	Paper Seal	Paper	1
3	Cap	Carbon Steel	1
4	Yoke Bushing	Bronze	2
5	Yoke	Carbon Steel	1
6	Thrust Bar	Alloy Steel	1
7	Guide Block	Carbon Steel	1
8	Rod Bushing	Steel+Bronze+PTFE	2
9	Steel Pin	Alloy Steel	1
10	Sliding Block	Bronze	2
11	Seeger	Alloy Steel	2
12	O-Ring	NBR	2
13	Screw	Alloy Steel	18
14	Steel Pin	Alloy Steel	2
15	Paper Seal	Paper	1
16	Indicator	Alloy Steel	1
17	Screw	Alloy Steel	2
18	O-Ring	NBR	1
19	Grub Screw	Alloy Steel	2
20	Accessories Bracket	Alloy Steel	1
21	Screw	Alloy Steel	4
22	Screw	Alloy Steel	8
23	CLOSED Label	Alloy Steel	1
24	OPEN Label	Alloy Steel	1
25	Data Label	Alloy Steel	1
26	Rivet	Alloy Steel	8
27	Filter	Brass	1
28	Inner Side Cap	Carbon Steel	1
29	Rod Bushing	Steel+Bronze+PTFE	1
30	Centering Ring	Alloy Steel	2
31	O-Ring	NBR	2
32	Piston Rod	Alloy Steel	1
33	Plate Rod Seal	Alloy Steel	1
34	O-Ring	NBR	1
35	Piston	Carbon Steel	1
36	Washer	Alloy Steel	1
37	Nut	Alloy Steel	1
38	O-Ring	NBR	1
39	Sliding Ring	PTFE+Graphite	1
40	Cylinder Tube	Carbon Steel	1
41	Outer Side Cap	Carbon Steel	1
42	Tie Rod	Alloy Steel	10
43	Nut	Alloy Steel	10
44	Lifting Ring	Carbon Steel	2
45	Screw	Alloy Steel	4
46	O-Ring Cap	Brass+NBR	2
47	O-Ring	NBR	1
48	Seal	Polyurethane	1
49	Paper Seal	Paper	2
50	Reduction Ring	Alloy Steel	1
51	Stop Setting Screw	Alloy Steel	1
52	Sealing Washer	Alloy Steel+NBR	2
53	Stop Nut	Alloy Steel	1
54	Stop Bolt Cover	Alloy Steel	1
55	O-Ring	NBR	1
56	Spring Cap	Carbon Steel	1
57	Spring Centering Ring	Alloy Steel	2

Num. Item	Description	Material	Quantity
58	Bush	Steel+Bronze+PTFE	1
59	Spring Cartridge Stem	Alloy Steel	1
60	Spring Flange	Carbon Steel	1
61	Nut	Alloy Steel	1
62	Spring	Spring Steel	1
63	Spring Cartridge	Carbon Steel	1
64	Inner Side Flange	Carbon Steel	1
65	Lifting Hook	Carbon Steel	1
66	Spring Stop Cap	Alloy Steel	1
67	Bonded	Alloy Steel+NBR	1
68	Spring Stop	Alloy Steel	1
69	Bearing	PTFE	2
70	Bush	Steel+Bronze+PTFE	1
71	Cap	Alloy Steel	2
72	Stem Extension	Alloy Steel	1
73	Screw	Alloy Steel	1